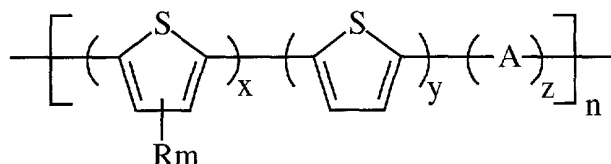


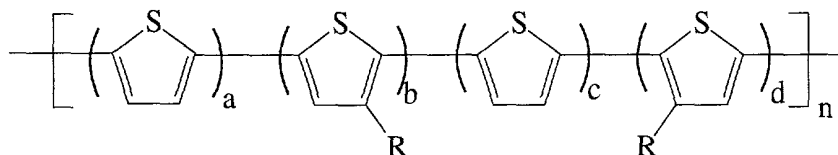
**WHAT IS CLAIMED IS:**

1. Polythiophenes of the formula



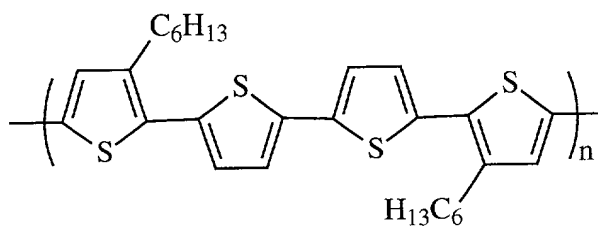
wherein R is a side chain; m is the number of substituents; A is a divalent linkage; x, y and z represent, respectively, the numbers of R substituted thiophylene, unsubstituted thiophylene, and divalent linkages A in the monomer segment with z being either 0 or 1; and n represents the number of the repeating monomer segments in the polymer chain or the degree of polymerization.

2. Polythiophenes in accordance with **claim 1** and which polythiophenes are represented by

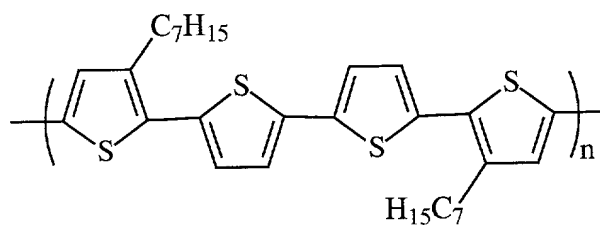


wherein R is a side chain; a is an integer of from about 0 to about 5; b, c, and d are integers of from about 1 to about 5; and n represents the degree of polymerization of from about 5 to about 5,000; the number average molecular weight ( $M_n$ ) of the polythiophenes is from about 2,000 to about 100,000, and the weight average molecular weight ( $M_w$ ) is from about 4,000 to about 500,000, each measured by gel permeation chromatography using polystyrene standards.

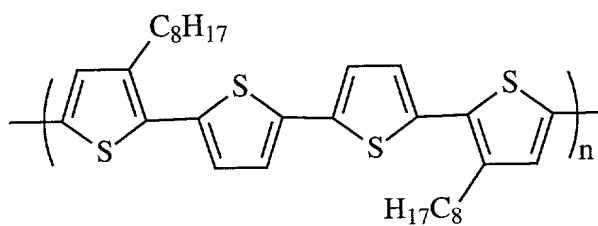
3. Polythiophenes in accordance with **claim 1** and of the formulas



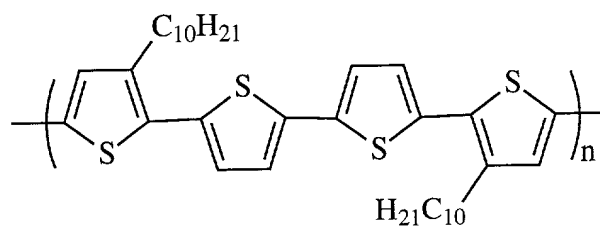
(II-a)



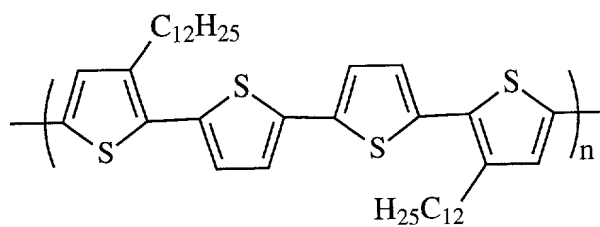
(II-b)



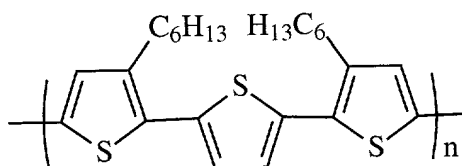
(II-c)



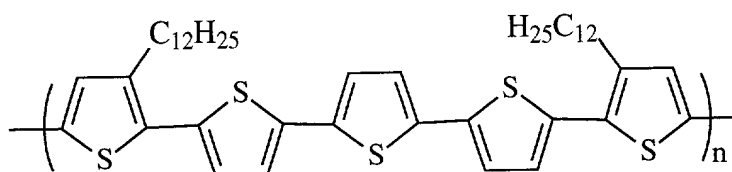
(II-d)



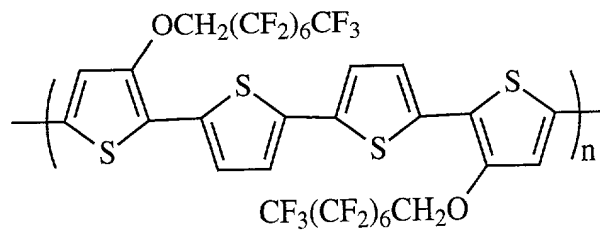
(II-e)



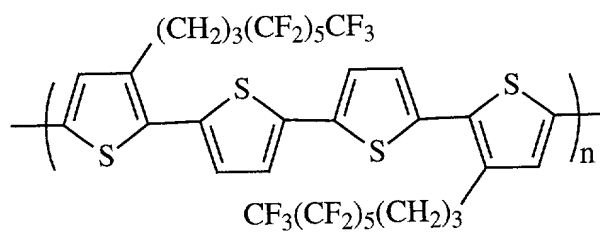
(II-f)



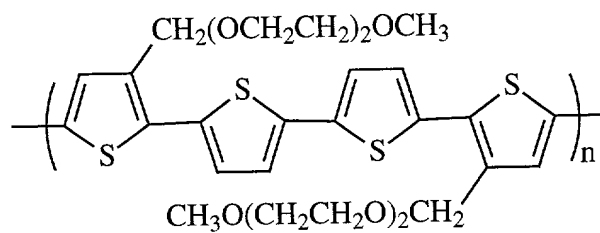
(II-g)



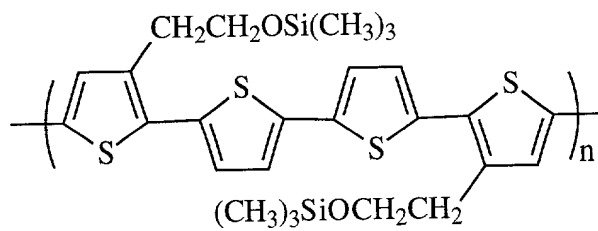
(II-h)



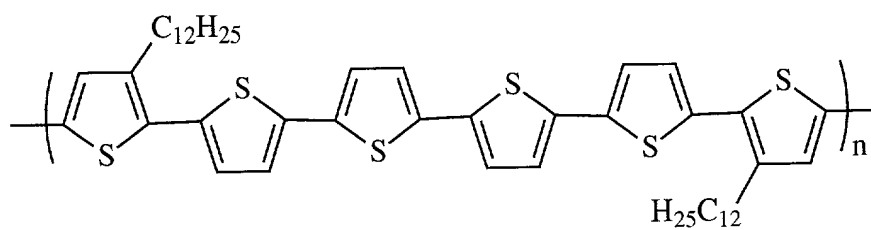
(II-i)



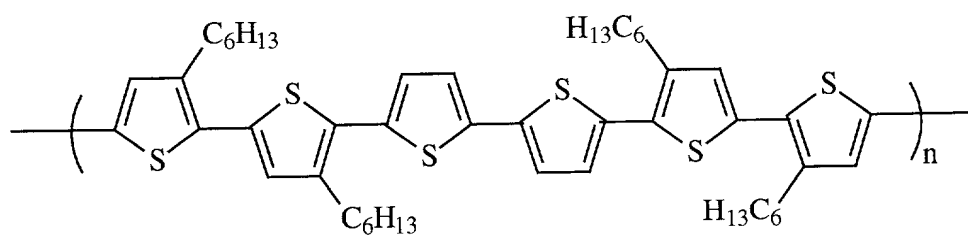
(II-j)



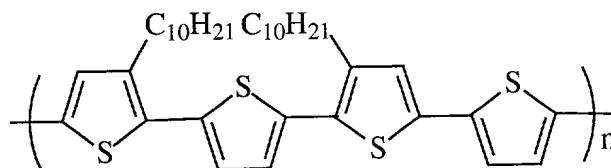
(II-k)



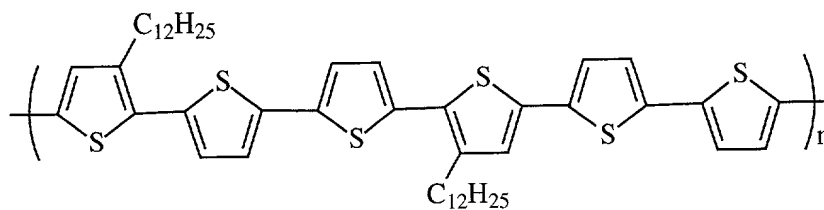
(II-l)



(II-m)

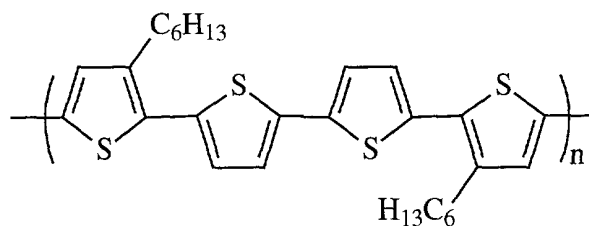


(II-n)

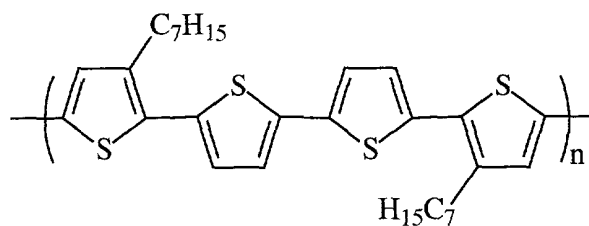


(II-o)

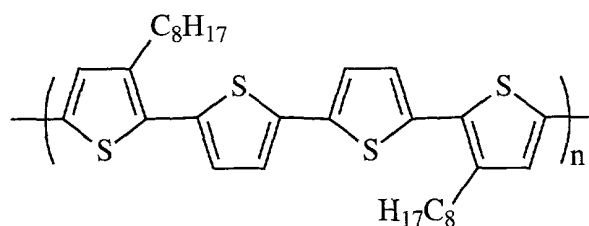
4. Polythiophenes in accordance with **claim 1** and of the formulas



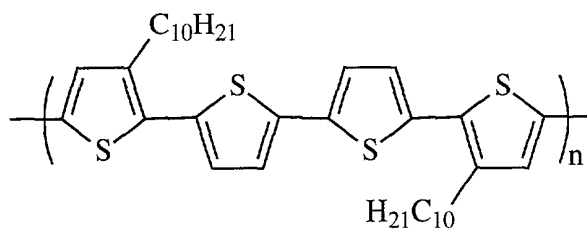
(II-a)



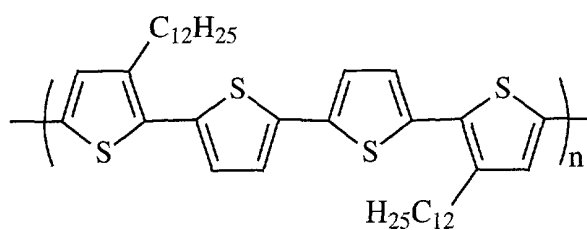
(II-b)



(II-c)



(II-d)



(II-e)

5. Polythiophenes in accordance with **claim 1** wherein m is 1.
6. Polythiophenes in accordance with **claim 1** wherein R is alkoxyalkyl, siloxy substituted alkyl, a perhaloalkyl, or a polyether.
7. Polythiophenes in accordance with **claim 1** wherein A is an arylene.
8. Polythiophenes in accordance with **claim 7** wherein said arylene possesses from about 6 to about 40 carbon atoms.

9. Polythiophenes in accordance with **claim 7** wherein said arylene is phenylene.

10. Polythiophenes in accordance with **claim 7** wherein said arylene is biphenylene, phenylthrenylene, fluorenylene, polymethylene, dioxyarylene, or 9,10-dihydrophenanthrenylene.

11. Polythiophenes in accordance with **claim 1** wherein m is 1 or 2.

12. Polythiophenes in accordance with **claim 1** wherein x, y, and z represent the number of segments of from 1 to about 5 for x and y, and z is zero (0) or 1.

13. Polythiophenes in accordance with **claim 1** wherein n is from about 5 to about 5,000; the number average molecular weight ( $M_n$ ) of the polythiophene is from about 2,000 to about 100,000; the weight average molecular weight ( $M_w$ ) is from about 4,000 to over 500,000, both  $M_w$  and  $M_n$  being measured by gel permeation chromatography using polystyrene standards.

14. Polythiophenes in accordance with **claim 1** wherein R is alkyl containing from 1 to about 20 carbon atoms; wherein n is from about 10 to about 1,000; the  $M_n$  is from about 4,000 to about 50,000; and the  $M_w$  is from about 5,000 to about 100,000.

15. Polythiophenes in accordance with **claim 1** wherein the alkyl side chain R contains from about 6 to about 12 carbon atoms.



16. Polythiophenes in accordance with **claim 1** wherein the alkyl side chain R is butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, or dodecyl.

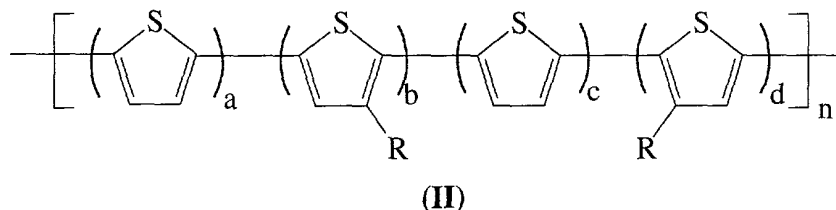
17. Polythiophenes in accordance with **claim 1** wherein the side chain R is a perfluoroalkyl of about 2 to about 15 carbon atoms.

18. Polythiophenes in accordance with **claim 1** wherein the side chain R is siloxyalkyl of trimethylsiloxyalkyl or triethylsiloxyalkyl, and wherein alkyl optionally contains from about 4 to about 10 carbons, and which alkyl is butyl, pentyl, hexyl, heptyl, or octyl.

19. Polythiophenes in accordance with **claim 1** wherein the divalent linkage A is an arylene with from about 6 to about 40 carbon atoms.

20. Polythiophenes in accordance with **claim 19** wherein the divalent linkage A is selected from the group consisting of phenylene, biphenylene, phenanthrenylene, 9,10-dihydrophenanthrenylene, fluorenylene, methylene, polymethylene, dioxyalkylene, dioxyarylene, and an oligoethylene oxide.

21. Polythiophenes in accordance with **claim 1** and represented by



wherein R is a side chain; a, b, c, and d represent the number of thienylene moieties; and n is the degree of polymerization of from about 100 to about 1,000.

22. Polythiophenes in accordance with **claim 21** wherein R is alkyl containing from about 1 to about 20 carbon atoms; or wherein R is alkyl containing from about 6 to about 12 carbon atoms.

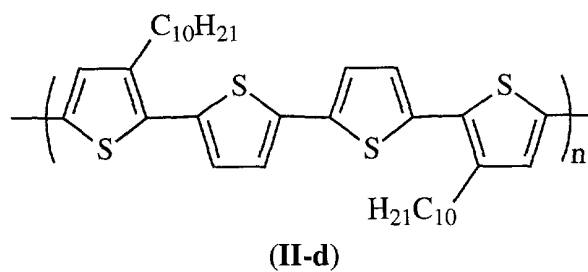
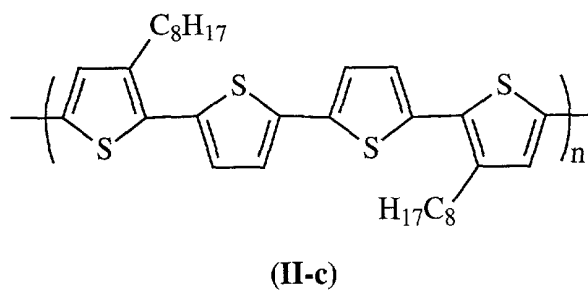
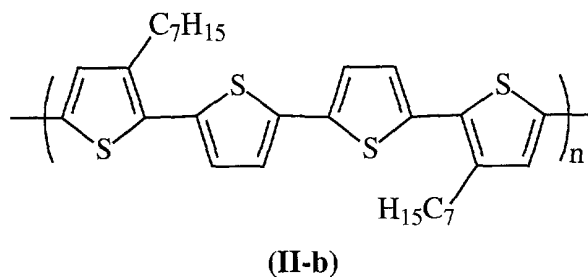
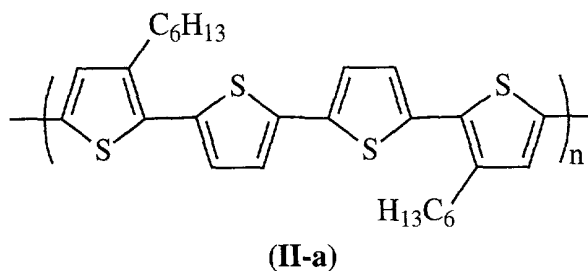
23. Polythiophenes in accordance with **claim 21** wherein R is butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, or dodecyl.

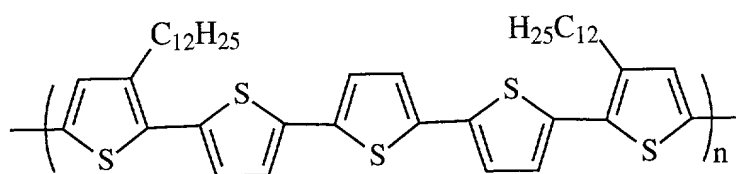
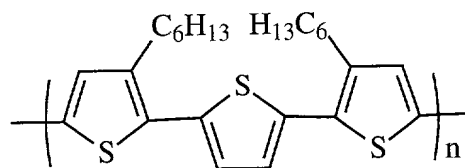
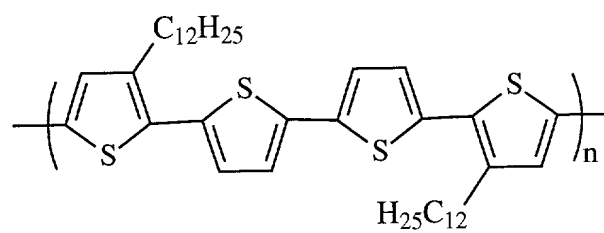
24. Polythiophenes in accordance with **claim 21** wherein b and d are from about 1 to about 5.

25. Polythiophenes in accordance with **claim 21** wherein b and d are from about 1 to about 3.

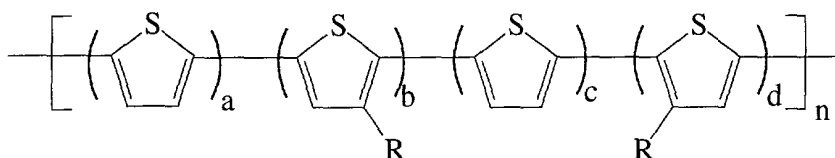
26. Polythiophenes in accordance with **claim 21** wherein a is from about 0 to about 5, and c is about 1 to about 5, or wherein a is about 0 to about 3, and c is about 1 to about 3.

27. Polythiophenes in accordance with **claim 1** wherein said polythiophene is selected from the group consisting of polythiophenes (II-a) through (II-o), and wherein n is from about 100 to about 4,000



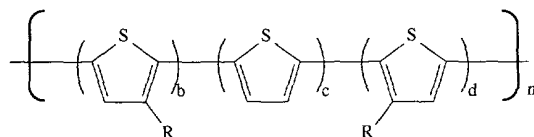


28. A process for the preparation of polythiophenes comprising reacting about 1 molar equivalent of a suitable monomer in an organic solvent with about 1 to about 5 molar equivalents of a ferric chloride at a temperature of from about 25°C to about 80°C, and which polythiophenes are of the formula



wherein a, b, c, and d represent the number of segments; each R is a side chain, and n represents the degree of polymerization or the number of repeating segments.

29. A process in accordance with **claim 28** which comprises reacting about 1 molar equivalent of monomer (IIIb) of the formula and which polythiophene is of the formula



with a 1.1 molar equivalent of Zn in anhydrous tetrahydrofuran, followed by treatment with a catalytic amount of [1,2-bis(diphenyl phosphinoethane)] dichloronickel (II) and subsequent reaction by heating at a temperature of about 30°C to about 80°C.

30. A process in accordance with **claim 28** wherein said R side chain is alkyl, substituted alkyl, or perhaloalkyl.

31. A process in accordance with **claim 28** wherein alkyl contains from 1 to about 25 carbon atoms or from 4 to about 15 carbon atoms; wherein substituted alkyl is alkoxy alkyl, or siloxy substituted alkyl; and said perfluoro is a polyether.

32. A process in accordance with **claim 28** wherein the relative positions of  $R_m$  substituted thienylene, unsubstituted thienylene, and A in the monomer segment are dissimilar than schematically presented in (I).

33. Polythiophenes in accordance with **claim 2** wherein arylene is phenylene, biphenylene, phenanthrenylene, 9,10-dihydrophenanthrenylene, fluorenylene, polymethylene, or dioxyalkylene, dioxyarylene.